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Post 28

Mechanism for boundary crises in quasiperiodically forced systems

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We investigate the mechanism for boundary crises in the quasiperiodically forced logistic map which is a representative model for quasiperiodically forced period-doubling systems. For small quasiperiodic forcing β, a chaotic attractor disappears suddenly via a ``standard" boundary crisis when it collides with the smooth unstable torus on the basin boundary. However, when passing a threshold value of β, a basin boundary metamorphosis occurs, and then the smooth unstable torus is no longer accessible from the interior of the basin of the attractor. For this case, using the rational approximations to the quasiperiodic forcing, it is found that a nonchaotic attractor (smooth torus or strange nonchaotic attractor) as well as a chaotic attractor is destroyed abruptly through a new type of boundary crisis when it collides with an invariant ``ring-shaped" unstable set on the basin boundary.

Post 29

Band-Merging transitions in quasiperiodically forced period-doubling systems

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As a representative model for quasiperiodically forced period-doubling systems, we consider the quasiperiodically forced logistic map, and study band-merging transitions by varying the nonlinearity parameter a of the logistic map and the amplitude β of the quasiperiodic forcing. In the $a-\beta$ plane, the curve of band-merging transition is found to lose its differentiability at two vertices. On the segment bounded by the two vertices, a new type of band-merging transition occurs for a nonchaotic attractor (smooth torus or strange nonchaotic attractor) as well as a chaotic attractor through a collision with an invariant ring-shaped unstable set. Particularly, a smooth period-doubled torus with two bands is found to transform into a single-band strange nonchaotic attractor via a new band-merging transition, which corresponds to a new mechanism for the appearance of